RECEIVED
CENTRAL FAX CENTER

OCT 19 2006

AMENDMENTS TO THE CLAIMS

1. (Currently amended) A method of forming a copper wiring in a semiconductor device, comprising:

providing a substrate in which a damascene pattern is formed in an interlayer insulating film;

forming a copper anti-diffusion conductive film and a copper layer on the structure including the damascene pattern;

forming a copper wiring in the damascene pattern by means of a chemical mechanical polishing process, wherein the chemical mechanical polishing process is performed until a top surface of the copper wiring is concave from a top view and the top surface of the copper wiring has a lowermost portion disposed below a top surface on the interlayer insulating film;

performing an annealing process to convert the concave top surface of the copper wiring to a convex top surface so that side edges of the copper wiring that engage the copper anti-diffusion conductive film are disposed below a top surface of the interlayer insulating film, wherein the annealing process is performed using an inert gas of N_2, Ar, H_2 or He or a mixture thereof, or in a vacuum state at a temperature in the range of 100°C to 700°C in a thermal annealing process; and

forming a copper anti-diffusion insulating film on the entire structure including the convex the top surface of the copper wiring having the convex shape, thereby flatting a surface of the entire structure.

2. (Canceled)

3. (Previously presented) The method as claimed in claim 1, further comprising the step of performing a cleaning process after the step of performing the chemical mechanical polishing process.

4. (Original) The method as claimed in claim 3, wherein the cleaning process is performed using a cleaning agent containing nitric acid so that the surface of the copper wiring is further lower than the surface of the interlayer insulating film.

5. (Previously presented) The method as claimed in claim 1, wherein the annealing process is performed in an inert gas atmosphere such as N_2, Ar, H_2 or He or a mixture thereof at a temperature in the range of 100°C to 500°C.

6. (Canceled)

7. (Previously presented) The method as claimed in claim 1, wherein a plasma processing is further performed between the fourth step and the fifth step.

8. (Original) The method as claimed in claim 7, wherein the plasma processing is carried out using a mixed gas containing nitrogen and hydrogen, a gas of a series of ammonia, or a mixed gas of hydrogen/an inert gas not containing nitrogen as an atmosphere gas at a temperature in the range of 100°C to 350°C.

9. (Original) The method as claimed in claim 1, wherein the copper anti-diffusion insulating film is formed by covering a material having a copper anti-diffusion property and a good fluidity property by means of a spin-on-deposition method, and then performing an annealing process for the material.

10. (Original) The method as claimed in claim 9, wherein the copper anti-diffusion insulating film is formed using materials such as methyl, benzochlorobutane, polyimide, arylether and hydrogen silsesquioxane, which contain Si, C and N in a type of a sol or gel.

11. (Original) The method as claimed in claim 9, wherein the annealing process is performed using an inert gas such as N_2, Ar, H_2 or He or a mixed gas of them at a temperature in the range of 100°C to 500°C.

12. (Original) The method as claimed in claim 9, wherein the annealing process is performed in a vacuum state at a temperature in the range of 100°C to 500°C.

13. (Currently amended) A method of forming a copper wiring in a semiconductor device, comprising:

sequentially forming an interlayer insulating film and an anti-polishing layer on a substrate;

forming a damascene pattern in the interlayer insulating film by etching a given

region of the anti-polishing layer and the interlayer insulating film;

forming a copper anti-diffusion conductive film and a copper layer on the structure including the damascene pattern;

forming a copper wiring by means of a chemical mechanical polishing process, wherein the chemical mechanical polishing process is performed until a top surface of the copper wiring is concave from a top view and the top surface of the copper wiring has a lowermost portion disposed below a top surface of the interlayer insulating film;

performing an annealing process to convert the concave top surface of the copper wiring to a convex top surface so that side edges of the copper wiring that engage the copper anti-diffusion conductive film are disposed below a top surface of the interlayer insulating film, and wherein the annealing process is performed in an inert gas atmosphere of N_2, Ar, H_2 or He or a mixture thereof, or in a vacuum state and at a temperature in the range of 100°C to 700°C; and

forming a selective copper anti-diffusion conductive film on the convex-top surface of the copper wiring having the convex shape.

14. (Canceled)

15. (Previously presented) The method as claimed in claim 13, further comprising the step of performing a cleaning process after the step of performing the chemical mechanical polishing process.

16. (Original) The method as claimed in claim 15, wherein the cleaning process is performed using a cleaning agent containing nitric acid so that the surface of the copper wiring is further lower than the surface of the interlayer insulating film.

17. (Previously presented) The method as claimed in claim 13, wherein the annealing process is performed in an inert gas atmosphere such as N_2, Ar, H_2 or He or a mixture thereof and at a temperature in the range of 100°C to 500°C.

18. (Canceled)

19. (Previously presented) The method as claimed in claim 13, wherein a plasma processing is further performed between the fourth step and the fifth step.

20. (Original) The method as claimed in claim 19, wherein the plasma processing is carried out using a mixed gas containing nitrogen and hydrogen, a gas of a series of ammonia, or a mixed gas of hydrogen/an inert gas not containing nitrogen as an atmosphere gas at a temperature in the range of 100°C to 350°C.

21. (Original) The method as claimed in claim 13, wherein the selective copper anti-diffusion conductive film is formed within the damascene pattern without causing a step with the interlayer insulating film.

22. (Original) The method as claimed in claim 21, the selective copper anti-diffusion conductive film is formed using a metal having a high melting point such as W, Ti, Ta, etc. or a compound such as Ni, Co, P, B, etc. by means of a selective electroless plating method.

23. (Original) The method as claimed in claim 21, the selective copper anti-diffusion conductive film is formed by means of a selective chemical vapor deposition (CVD) method.

24. (Original) The method as claimed in claim 13, the selective copper anti-diffusion conductive film is formed using a metal having a high melting point such as W, Ti, Ta, etc. or a compound such as Ni, Co, P, B, etc. by means of a selective electroless plating method.

25. (Original) The method as claimed in claim 13, the selective copper anti-diffusion conductive film is formed by means of a selective chemical vapor deposition (CVD) method.